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GENETIC VARIABILITY STUDIES IN GLADIOLUS (GLADIOLUS HYBRIDUS HORT.) UNDER SUB HUMID CONDITION OF RAJASTHAN

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ABSTRACT

Twelve genotypes African Star, Arti, Darshan, Friendship, Hunting Song, Legend, Pusa Srijana, Pusa Kiran, Snow Princess, Sunayana, Trader Horn and Urmi of gladiolus were evaluated to determine genetic variability, heritability, genetic advance and genetic gain for twenty seven contributing characters. The gladiolus genotypes were procured from the Indian Agricultural Research Institute, New Delhi. The high value of PCV along with GCV indicated that there is more variability in the characters like, days to 50% sprouting, sprouts per corm, spikes diameter, duration of flowering, number of side spikes per plant, number of corms per plant, size index of corm, number of florets remaining open at a time and number of florets remaining unopened. High heritability with high values of genetic advance was observed for weight of cormels per plant, number of cormels per plant, rachis length, spike length, weight of corms and number of spikes per plot.

KEYWORDS: Gladiolus, Genetic Advance, Genetic Gain, Heritability And Variability

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Original Article

INTRODUCTION

Gladiolus (*Gladiolus hybridus* Hort.) is very popular cut spike, commonly known as 'Sword Lily'. It is native to South Africa. Gladiolushas the basic chromosome number n=15. Most member of genus are heteroploids having the very small chromosomes ranging from 2n=30 to 120 (diploid, triploid, tetraploid, pentaploid, hexaploid, octaploid and hyperaneauploid).It is important commercial bulbous crop and having pivotal place as cut spike both in domestic and international markets. Gladiolus was introduced into cultivation towards the end of the sixteenth century. It is relatively easy to grow and is ideal for bedding and exhibition purposes. The spikes are used in spike arrangement, in bouquets and for indoor decorations. Popularity of this crop as a cut spike is increasing day by day because of its long keeping quality and exhaustive range of colours of the spikes. It stands fourth in the international cut flower trade after carnation, rose and chrysanthemum. Heritability tells us about the additive genetic variance and phenotypic variance. High heritability alone is not enough to make efficient selection in segregating generation, unless the information is accompanied for substantial amount of genetic advance. In all plant species including gladiolus the phenotypic expression of a character is governed mainly by the genetic make-up of the plant. Environmental factors in combination with genetic and physiological factors play an important role in determination of plant potential for propagating material. These characters appear to be under strong genetic control. The studies on variability and genetic parameters are of paramount importance for crop improvement programme. Since meager information is available on these aspects, hence the present

investigation was under taken to obtain information on genetic parameters.

MATERIALS AND METHODS

The present investigation was carried out during 2014-15 at the Instructional Farm, Department of Floriculture & Landscaping, College of Horticulture & Forestry, Jhalarapatan, Jhalawar, to identify important yield attributing characters for developing high yielding genotypes in gladiolus and to study performance of gladiolus under Jhalawar condion. The soil had organic carbon 0.48 %, available nitrogen 240.68 kg/ha, available phosphorus 16.83 kg/ha and available potash 299.0 kg/ha. Well decomposed vermicompost at the rate of 5 kg/sqm was applied at the time of land preparation. Recommended dose of NPK (30:20:20 g/m²) was applied in the form of Urea, Single Super Phosphate and Muriate of Potash, respectively. After field and plot preparations the varieties were allocated to experimental plots through randomization. For planting of corms two shallow furrows at 30 cm distance were prepared in each plot with the help of kudali. Treated corms (with bavistin 0.2%) were planted at a distance of 20 cm with depth 6-8 cm in these furrows on 2 November, 2014. Total 16 corms of specific variety were planted in each plot. Earthing up of plants was also done at the time of manual weeding after 45 days of planting to support the plants. The crop didn't face any serious attack of diseases and pests. However, drenching of soil with bavistin with irrigation water and two spray of bavistin @ 0.2%, a spray of monocrotophos 35 EC @ 2 ml/l of water for control insect-pests in the later stage of crop growth has made. The genetic parameters such as genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability and genetic advance in broad sense.

Phenotypic and Genotypic Variance

Phenotypic and genotypic variances were calculated as per formulae given by Singh and Chaudhary (1979).

Genotypic variance (σ_g^2) = $\frac{\text{Treatment MSS} - \text{Error MSS}}{\text{Number of replication}}$

Phenotypic variance (σ_p^2) = (σ_g^2+σ_e^2)

Where,

σ_e^2 = Error MSS

Coefficient of Variation

The phenotypic and genotypic coefficient of variation for all characters were calculated by the method as suggested by Singh and Chaudhary (1979).

Phenotypic Coefficient of Variation (PCV)

PCV = $\frac{\sqrt{\sigma_p^2}}{\text{X}} \times 100$

Where,

σ_p^2 = Phenotypic variance

X = General mean of the character

Genotypic Coefficient of Variation (GCV)

$$GCV = \frac{\sqrt{\sigma_g^2}}{X} \times 100$$

Where,

σ_g^2 = Genotypic variance

X = General mean of the character

Heritability (h^2)

Heritability in broad sense was estimated as a ratio of genotypic variance (Falconer, 1981).

$$h^2 = \frac{\sigma_g^2}{\sigma_p^2}$$

Where,

σ_g^2 and σ_p^2 are genotypic and phenotypic variances, respectively.

Genetic Advance

This was calculated by using the formula as given by Johnson *et al*. (1955).

$$GA = \frac{\sigma_g^2}{\sigma_p^2} \times k.6p$$

Where,

Vg = genotypic variance

Vp = Phenotypic variance

6p = Phenotypic standard deviation

k = Selection of differential at a particular selection intensity the 'k' value is 2.06 at 5 per cent intensity of selection as per Falconer (1981).

As shown by Johnson *et al*. (1955) the genetic advance can also be expressed as percentage of the population mean to show the relationship of the genetic coefficient of variation and heritability.

$$GAM = \frac{GA}{\text{General mean}} \times 100$$

RESULTS & DISCUSSIONS

The analysis of genetic variability revealed that the genotypes evaluated consisted of established cultivars and the new hybrids, therefore, they are all expected to be homozygous genotypes. When high heritability is accompanied with high genetic advance it indicates additive gene effects and selection may be effective. High heritability with low genetic advance indicates importance of non-additive gene effects, while low heritability with high genetic advance is governed by additive gene effects and low heritability accompanied with low genetic advance indicates that the character is highly influenced by environmental factors and selection would be ineffective (Bhujbal *et al*. 2013). Very high heritability was

observed in sprouted corm percent(100%) and least heritability in days to 50% sprouting (29.66%) and days to wilting basal floret (27.36%)(Bhujbal *et al*. 2013). The high value of PCV along with GCV indicated that there is more variability in the characters like, days to 50% sprouting (pcv;16.63-gcv;9.06), sprouts per corm (pcv;28.97-gcv;23.77), spikes diameter(pcv;11.91-gcv;8.53), duration of flowering(pcv;21.13-gcv;14.81), number of side spikes per plant (pcv; 236.29-gcv;233.76), number of corms per plant(pcv;24.75-gcv;18.90), size index of corm(pcv;24.24-gcv;23.38), number of florets remaining open at a time(pcv;18.17-gcv;10.78) and number of florets remaining unopened (pcv;84.21-gcv;79.79).These results in agreement with the results of Panwar *et al*. (2013) in marigold and Singh and Mishra (2008) in marigold.

Closeness between PCV and GCV indicated that the phenotypic expression of all the genotypes is mostly under genetic control and environment has less influence on their expression This also suggests the presence of sufficient genetic variability which can exploited by practicing pure line selection (Pavan *et al*. 2011). The high values of genetic advance coupled with high estimates of heritability was observed for weight of cormels per plant (ga; 38.50, h;99.61), number of cormels per plant (ga;9.71, h;86.17), rachis length (ga; 21.22, h; 96.00), spike length (ga;24.69, h;89.69), weight of corms (ga;22.01, h;88.40) and number of spikes per plot(ga; 10.04, h; 85.93). This indicates the lesser influence of environment in expression of these characters and prevalence of additive gene action in their inheritance hence, amenable for simple selection (Balram and Janakiram 2009 and Bhujbal *et al*. 2013). High heritability with moderate genetic advance was observed for size index (ga;6.21, h; 93.03), number of corms per plot(ga;9.71, h;86.17), number of florets per spike (ga;5.14, h;84.55), diameter of corm (ga;8.57, h;75.19) and days to first spike emergence (ga;8.01, h;73.65). This indicates that the character was also governed both additive gene actions and environment expression (Archana *et al*., 2008). High heritability coupled with low genetic advance was recorded for number of side spikes (ga;1.52, h;97.87), number of florets remaining unopened(ga;2.86, h;89.79) and floret diameter (ga;1.14, h;70.64). These traits indicate non additive gene action and this selection with adequate progeny testing may be practiced (Archana *et al*. 2008).Thus appeared that additive genes operate for these traits, such as plant height, days to first floret opening, days to 50% flowering and duration of flowering (Choudhary *et al.* 2012). Vase life showed moderate to high heritability (69.83%) and improvement could be achieved for these traits through selection. Similar heritability estimates were reported by Singh *et al*. (2007) and Maurya *et al.* (2011) in gladiolus.

CONCLUSIONS

On the basis of finding of the present experiment the following conclusion may be drawn. These characters may be considered by breeder for breeding program. High heritability with high values of genetic advance was observed for weight of cormels per plant, number of cormels per plant, rachis length, spike length, weight of corms and number of spikes per plot.

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APPENDICES

Table 1: Range, Mean, Phenotypic Coefficient of Variation (PCV), Genotypic Coefficient of Variation (GCV), Environment Coefficient of Variation (ECV), Heritability, Genetic Advance and Genetic Advance Mean per cent for Vegetative and Floral Characters in Gladiolus

CHARACTERS	RANGE	MEAN	PCV (%)	GCV (%)	ECV (%)	H (%)	GA (%)	GAM (%)
Days to 50 % sprouting	5.67-8.00	6.75	16.63	9.06	13.95	29.66	0.69	10.16
Sprouted corm per cent	100.0-100.0	100.00	0.00	0.00	0.00	100.00	0.00	0.00
Sprouts per corm	1.00-2.67	1.68	28.97	23.77	16.56	67.31	0.68	40.17
Number of leaves/plant	6.83-9.75	8.03	13.93	11.36	8.06	66.54	1.53	19.09
Plant height (cm)	89.84-137.0	113.25	11.88	9.86	6.63	68.87	19.09	16.85
Days to first spike emergence	65.42-79.33	73.79	7.15	6.14	3.67	73.65	8.01	10.85
Days to first floret opening	80.87-95.21	88.25	5.70	4.39	3.74	59.40	4.45	5.17
Days to 50% flowering	81.67-95.33	88.88	5.28	4.29	3.27	65.92	3.67	4.10
Spike length (cm)	77.74-123.38	97.18	13.75	13.02	4.41	89.69	24.69	25.40
Rachis length (cm)	28.19-66.26	46.32	23.17	22.70	4.63	96.00	21.22	45.81
Spike diameter (cm)	0.74-0.98	0.87	11.91	8.53	8.30	51.30	1.11	12.60
Floret diameter (cm)	8.26-10.93	9.10	8.62	7.24	4.67	70.64	1.14	12.54
Duration of flowering	8.33-16.17	12.86	21.13	14.81	15.07	49.13	2.75	21.38
Number of Florets per spike	10.50-20.08	14.66	20.15	18.53	7.92	84.55	5.14	35.09
Number of side spikes per plant	0.00-2.08	0.32	236.29	233.76	34.51	97.87	1.52	476.38

Table 2: Range, Mean, Phenotypic Coefficient of Variation (PCV), Genotypic Coefficient of Variation (GCV), Environment Coefficient of Variation (ECV), Heritability, Genetic advance and Genetic advance mean per cent for yield, Corm and vase Characters in Gladiolus

CHARACTERS	RANGE	MEAN	PCV (%)	GCV (%)	ECV (%)	H (%)	GA (%)	GAM (%)
Number of spikes per plot	17.33-37.00	27.55	20.59	19.08	7.72	85.93	10.04	36.44
Number of corms per plant	1.08-2.50	1.74	24.75	18.90	15.97	58.35	0.52	29.75
Number of corms per plot	16.33-37.67	27.81	19.66	18.25	7.31	86.17	9.71	34.91
Number of cormels per plant	15.50-70.83	38.37	46.91	46.69	4.58	99.05	36.72	95.71
Diameter of corm (cm)	5.55-7.24	6.45	8.57	7.43	3.41	75.19	8.57	13.27
Weight of corm (g)	49.69-90.71	65.82	18.20	17.11	4.27	88.40	22.01	33.14
Weight of cormels per plant(g)	9.57-65.50	26.88	69.79	69.65	4.37	99.61	38.50	143.20
Size index of corms (cm^2)	9.06-18.83	13.37	24.24	23.38	6.40	93.03	6.21	46.46
Vase life of spikes (days)	11.33-17.56	15.01	11.27	9.42	6.19	69.83	2.43	16.21
Number of florets remaining open at a time	4.22-6.78	5.31	18.17	10.78	14.62	35.19	0.70	13.16
Days to wilting of basal floret	4.89-7.00	5.95	12.31	6.44	10.50	27.36	0.41	6.96
Number of florets remaining unopened	0.00-3.89	1.83	84.21	79.79	26.94	89.79	2.86	155.80